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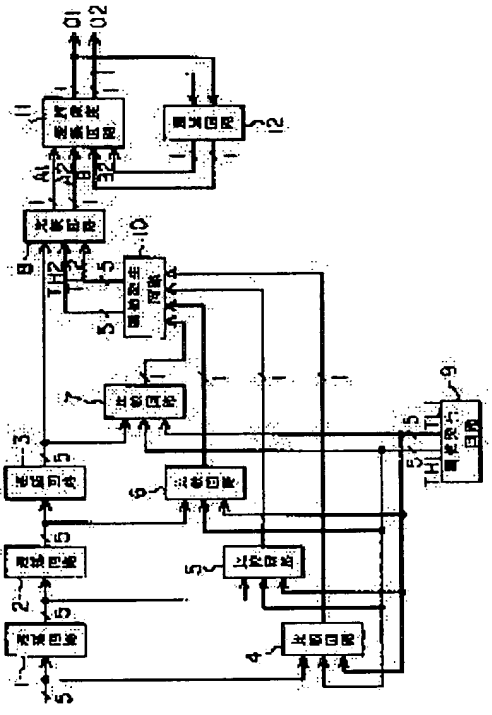
(54) IMAGE PROCESSING UNIT

(57)Abstract:

PURPOSE: To obtain image data whose resolution is enhanced with fidelity to a substantial image without causing a pattern such as a stripe pattern.

CONSTITUTION: A threshold level generating circuit 10 selects 1st and 2nd level used to divide usually a read range into three equal divisions as threshold levels TH2, TL2. When delay circuits 1-3 and comparator circuits 4-7 are used to discriminate picture element data received by a comparator circuit 8 and three preceding picture element data to have a medium luminance, a 3rd level used to divide a read range equally into two is outputted as threshold levels TH2, TL2. Then the comparator circuit 8 classifies each picture element into three luminance being high luminance over the threshold level TH2, a medium luminance between the threshold levels TH2 and TL2, and a low luminance smaller than the threshold level TL2 based on the threshold levels TH2 and TL2 outputted by the threshold level generating circuit 10, and a resolution conversion circuit 11 converts the picture element with high luminance into two white level picture elements, the picture element with medium luminance into one white level picture element and one black level picture element and the picture element with low luminance into two black level picture elements.



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CLAIMS

[Claim(s)]

[Claim 1] The image processing system which the number of pixel data is double precision about the image data which becomes by the array of the pixel data in which the intensity level of the pixel of a large number which are arranged at two dimensions, respectively and constitute a picture was shown by the multiple value characterized by providing the following, and each pixel data changes into the image data which shows a 1-pixel state with binary. A judgment means to judge whether two or more aforementioned reference pixel data of all are inside brightness while classifying into high brightness, inside brightness, and either of the low brightness each of the reference pixel data in which two or more reference pixels which are in a position to the pixel corresponding to each pixel data are shown based on the 1st predetermined threshold and the 2nd predetermined threshold smaller than this 1st threshold. A classification means to classify into high brightness, inside brightness, and either of the low brightness based on the 1st threshold of the above, and the 2nd threshold of the above when not judged with all reference pixel data being inside brightness by the aforementioned judgment means, and to classify each pixel data into either high brightness and low brightness according to the aforementioned judgment means based on the 3rd predetermined threshold when [all whose reference pixel data are inside brightness] judged. The pixel data according to which the pixel data classified into inside brightness again at two pixel data which the pixel data classified into high brightness according to this classification means show a white pixel, respectively were classified into one pixel data in which one pixel data in which a white pixel is shown, and black pixel are shown, and low brightness are a conversion means to change into two pixel data in which a black pixel is shown, respectively, respectively.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention is used for facsimile apparatus etc. and relates to the image processing system which changes the multiple-value image data of a certain resolution into the binary image data of the resolution of double precision.
[0002]
[Description of the Prior Art] The resolution obtained is restricted by the arrangement density of the optoelectric transducer in image sensors when read of a picture is performed using image sensors, such as a CCD line sensor. That is, when the image sensors which come to arrange an optoelectric transducer by mm in eight pieces /are used, resolution is set to mm in 8 pixels /at the maximum.
[0003] For this reason, if it is going to obtain bigger resolution, image sensors with the high arrangement density of an optoelectric transducer will be used. However, since manufacture also becomes difficult while a needed element number increases so that the arrangement density of an optoelectric transducer becomes high, image sensors become expensive. Therefore, if image sensors with the high arrangement density of an optoelectric transducer are used, elevation of equipment cost will be caused.
[0004] Then, each pixel is classified into high brightness, inside brightness, and three of low brightness based on the intensity level. To the pixel of high brightness, two white pixels by assigning two black pixels to one white pixel, one black pixel, and the pixel of low brightness to the pixel of inside brightness, respectively It considers generating binary image data with the resolution of the double precision of the resolution obtained by image sensors. According to this, the image data of high resolution is generable using cheap image sensors with the low arrangement density of an optoelectric transducer.
[0005] However, since a white pixel and a black pixel would be arranged by turns in the picture after conversion when are processed as mentioned above and the pixel classified into inside brightness is continuing, there was fault that patterns, such as a striped pattern, will appear.
[0006]
[Problem(s) to be Solved by the Invention] When two pixels were assigned according to the intensity level of each pixel as mentioned above and it processed to a picture of what can raise resolution which the pixel of a gray level follows, for example like a photograph, patterns, such as a striped pattern, appeared in the picture after processing, and there was fault of becoming an unnatural picture.
[0007] this invention is made in consideration of such a situation, and the place made into the purpose is to offer the image processing system which can obtain the image data which raised resolution while it had been faithful to an original picture, without producing patterns, such as a striped pattern.
[0008]
[Means for Solving the Problem] In order to attain the above purpose this invention As opposed to the pixel corresponding to each pixel data Each of the reference pixel data in which the reference pixel of plurality (three [for example,]) in a position is shown is based on the 1st predetermined threshold and the 2nd predetermined threshold (for example, the 1st level and the 2nd level which divide a reading range into three equally) smaller than this 1st threshold. High brightness, A judgment means to judge whether two or more aforementioned reference pixel data of all are inside brightness while classifying into inside brightness and either of the low brightness, Each pixel data is based on the 1st threshold of the above, and the 2nd threshold of the above, when not judged with all reference pixel data being inside brightness by the aforementioned judgment means. High brightness, A classification means to classify into inside brightness and either of the low brightness, and to classify into either high brightness and low brightness according to the aforementioned judgment means based on the 3rd predetermined threshold (for example, the 3rd level which divides a reading range into two equally) when [all whose reference pixel data are inside brightness] judged, To two pixel data in which a white pixel is shown, the pixel data classified into high brightness according to this classification means, respectively Moreover, the pixel data according to which the pixel data classified into inside brightness were classified into one

pixel data in which one pixel data in which a white pixel is shown, and black pixel are shown, and low brightness were equipped with a conversion means to change into two pixel data in which a black pixel is shown, respectively, respectively.
[0009]
[Function] By having provided such a means, each pixel data It is judged to high brightness, inside brightness, and any of low brightness the intensity level belongs fundamentally. To two pixel data in which a white pixel is shown, the pixel data classified into high brightness, respectively Moreover, the pixel data according to which the pixel data classified into inside brightness were classified into one pixel data in which one pixel data in which a white pixel is shown, and black pixel are shown, and low brightness are changed into two pixel data in which a black pixel is shown, respectively. However, the pixel all whose reference pixels of plurality (three [for example,]) that are in a position to each pixel are inside brightness is changed into two white pixels or two black pixels according to whether the intensity level is the 3rd predetermined more than threshold, and is not changed into the combination of one white pixel and one black pixel. Therefore, even if the pixel of inside brightness is continuing, it is prevented that a white pixel and a black pixel arise by turns.
[0010]
[Example] Hereafter, with reference to a drawing, it explains per example of this invention. Drawing 1 is the functional block diagram showing the composition of the image processing system concerning this example. Among drawing, 1, 2, and 3 are delay circuits, respectively, and they are connected in series. And image data is inputted into the delay circuit 1, and every 1 pixel of each delay circuits 1-3 is delayed in this image data. In addition, using a CCD line sensor etc., image data carries out the raster scan of the manuscript, is obtained, and becomes by the array of the pixel data to which it comes to show each pixel by the 5-bit intensity level.
[0011] 4, 5, 6, 7, and 8 are comparator circuits, respectively, and the image data which a delay circuit 2 outputs [the image data which a delay circuit 1 outputs / the image data inputted into a comparator circuit 4 at a delay circuit 1 / to a comparator circuit 5] to a comparator circuit 6, and the image data which a delay circuit 3 outputs to a comparator circuit 7 and a comparator circuit 8 are inputted, respectively. Moreover, two thresholds TH2 and tangent line2 which the threshold generating circuit 10 has generated [two thresholds TH1 and tangent line1 which the threshold generating circuit 9 has generated] in the comparator circuit 8 are inputted into each of comparator circuits 4-7, respectively.
[0012] the threshold generating circuit 9 -- white-level >TH1>tangent line1> -- black level -- the predetermined thresholds TH1 and tangent line1 set up so that a relation might be realized are outputted And comparator circuits 4-7 output "0", when the level of input image data is between a threshold TH1 and a threshold tangent line 1 about the level of each input image data as compared with a threshold TH1 and a threshold tangent line 1. Each output of comparator circuits 4-7 is inputted into the threshold generating circuit 10.
[0013] The threshold generating circuit 10 outputs the threshold TH2 of the same value as a threshold TH1, and the threshold tangent line 2 of the same value as a threshold tangent line 1, respectively, when at least one of each of the output of comparator circuits 4-7 is "1." moreover -- the time of each outputs of all of comparator circuits 4-7 being "0" -- white-level >TH2=tangent line2> -- black level -- the predetermined value set up so that a relation might be realized is outputted as thresholds TH2 and tangent line2 And a comparator circuit 8 outputs the signal A1 which shows whether the level of input image data is two or more thresholds TH about the level of input image data as compared with a threshold TH1 and a threshold tangent line 1, and the signal A2 which shows whether the level of input image data is two or more thresholds tangent line, respectively.
[0014] 11 is a resolution conversion circuit and the signals A1 and A2 which a comparator circuit 8 outputs are inputted, respectively. Moreover, the signal B1 and B-2 which the outputs O1 and O2 were delayed by the delay circuit 12 by 1 pixel, and obtained them are inputted into the resolution conversion circuit 11, respectively. And the resolution conversion circuit 11 determines and outputs two signals O1 and O2 which show 1-pixel white/black respectively according to the pattern set up beforehand according to four input signals A1, A2, and B1 and the state of B-2.

[0015] Next, operation of the image processing system constituted as mentioned above is explained. First, after image data is total and receives delay for 3 pixels by delay circuits 1-3, it is inputted into a comparator circuit 8. The threshold generating circuit 10 has given the value equivalent to the 1st level and the 2nd level which were set up so that a reading range (level width of face from a white level to black level) might be equally divided into about three, as usually shown in drawing 2 (a) to the comparator circuit 8 as thresholds TH2 and tangent line2. By the comparator circuit 8, the signal A1 which shows whether the level of image data is higher than the 1st level (it is "1" when high), and the signal A2 which shows whether the level of image data is higher than the 2nd level (it is "1" when high) are outputted in this way. Namely, if a comparator circuit 8 has the level of image data in the range (high brightness) from a white level to the 1st level, it will set both the signals A1 and A2 to "1." If the level of image data is in the range (inside brightness) from the 1st level to the 2nd level, a signal A1 "0", If A2 is set to "1" and the level of image data is in the range (low brightness) from the 2nd level to black level, both the signals A1 and A2 would be set to "0", and it will have classified into high brightness, inside brightness, and either of the low brightness.

[0016] On the other hand, the threshold generating circuit 9 is always outputting the value equivalent to the 1st level and the 2nd level which were set up so that a reading range might be equally divided into about three, as shown in drawing 2 (a) as thresholds TH1 and tangent line1. Therefore, also in comparator circuits 4-7, comparison with the level of image data, the 1st level, and the 2nd level is performed. However, the image data before being delayed by the delay circuit 1 to a comparator circuit 4 Data after the image data after being delayed by the delay circuit 1 to the comparator circuit 5 was delayed by delay circuits 1 and 2 to the comparator circuit 6, respectively And since data after being delayed by delay circuits 1-3, respectively are inputted into the comparator circuit 7, respectively A comparator circuit 7 is related with the pixel data in front of one about the pixel data inputted into the comparator circuit 8 at main scanning direction to the pixel data by which the comparator circuit 6 is inputted into the comparator circuit 8. A comparator circuit 5 compares level with main scanning direction about the pixel data in front of three about the pixel data in front of two at main scanning direction to the pixel data into which the comparator circuit 4 is inputted at the comparator circuit 8 to the pixel data inputted into the comparator circuit 8, respectively. Moreover, comparator circuits 4-7 are making only a judgment whether they are whether the level of image data is between the 1st level and the 2nd level, and inside brightness.

[0017] And if at least one of each outputs of comparator circuits 4-7 is "1", the threshold generating circuit 10 As opposed to the pixel data inputted into the comparator circuit 8, and this pixel data to main scanning direction Namely, before one, Thresholds TH2 and tangent line2 are outputted as mentioned above noting that it will be a normal state, if at least one of four pixel data (main scanning direction is followed) with each pixel data in front of two and three is classified in addition to "halftone."

[0018] However, when all of each output of comparator circuits 4-7 of the threshold generating circuit 10 are "0", As opposed to the pixel data inputted into the comparator circuit 8, and this pixel data to main scanning direction Namely, before one, When all of the four pixel data (main scanning direction is followed) with each pixel data in front of two and three are classified into "halftone", thresholds TH2 and tangent line2 are changed with a normal state. Let thresholds TH2 and tangent line2 be the values equivalent to the 3rd level which specifically [both] divides a reading range into about two equally as shown in drawing 2 (a).

[0019] Both the signals A1 and A2 that will be outputted from a comparator circuit 8 if it does so turn into a signal which shows whether the level of image data is the 3rd more than level, if the level of image data is the 3rd more than level, they will set both the signals A1 and A2 to "1", and if the level of image data is the 3rd less than level, they will set both the signals A1 and A2 to "0." That is, in this state, a comparator circuit 8 will carry out operation same with making image data binary simply.

[0020] Now, the resolution conversion circuit 11 searchs the signal B1 which the signals A1 and A2 which a comparator circuit 8 outputs, and a delay circuit 12 output, and the table shown in drawing 3 based on B-2, and determines it as either of "0" which shows "1" or the black pixel which shows a white pixel for signals O1 and O2, respectively. Specifically [both], when [both] signals A1 and A2 are "1",

signals O1 and O2 are set to "1" irrespective of a signal B1 and the state of B-2. Moreover, when [both] both the signals A1 and A2 are "0", signals O1 and O2 are set to "0" irrespective of a signal B1 and the state of B-2. And by "0", when a signal A2 is "1", a signal A1 sets either of the signals O1 and O2 to "0", and sets another side to "1." However, when both a signal B1 and B-2 are "0" with reference to a signal B1 and the state of B-2 at this time, a signal O1 is set to "0", a signal O2 is set to "1", in except [it], a signal O1 is set to "1" and a signal O2 is set to "0." In addition, a signal O1 corresponds to the pixel of a main-scanning-direction anterior, and a signal O2 corresponds to the pixel of a main-scanning-direction posterior, respectively.

[0021] It is changed into the array of a pixel as shown in drawing 2 (c) when processing by the above processings to a picture signal as shown in drawing 2 (a) which shows the array of a pixel as shown in drawing 2 (b) in this way. That is, the pixel P2 according to which an intensity level is classified into high brightness, P5, and P12 are changed into two white pixels, respectively. Moreover, the pixels P1 and P3 according to which an intensity level is classified into low brightness are changed into two black pixels, respectively. And the pixel according to which an intensity level is classified into inside brightness is usually changed into one white pixel and one black pixel. The pixel (the pixel P4 in drawing 2 corresponds) from which the front pixel is changed into two black pixels according to the conversion situation of a front pixel in this case the pixel of an anterior In addition, a black pixel, The pixel (the pixels P7 and P8 in drawing 2 correspond) changed into the pixel (the pixel P6 in drawing 2 corresponds) or one black pixel from which the pixel of a posterior is made into a white pixel, and the front pixel is changed into two white pixels, and one white pixel makes a white pixel and the pixel of a posterior a black pixel for the pixel of an anterior. Even if an intensity level is the pixel classified into inside brightness, however, the pixel (the pixels P9, P10, and P11 in drawing 2 correspond) all of whose three pixels of an anterior are inside brightness The pixel (the pixel P11 in drawing 2 corresponds) whose intensity level is the 3rd more than level is made into two white pixels, and let the pixels (the pixels P9 and P10 in drawing 2 correspond) with which an intensity level does not fill the 3rd level be two black pixels.

[0022] According to this example, the intensity level of each pixel fundamentally Thus, high brightness, The pixel belonging to high brightness according to to inside brightness and three any of low brightness it belongs to two white pixels The image data which has the resolution of the double precision of the image data of a basis is generated by changing into two black pixels the pixel to which the pixel belonging to inside brightness belongs to one white pixel, one black pixel, and low brightness, respectively.

[0023] And although the pixel to the 3rd is changed into one white pixel and one black pixel like **** when four or more pixels of inside brightness continue, the pixel after the 4th is changed into two white pixels or two black pixels according to whether it is the 3rd more than level which the intensity level reads and divides a range into two equally. It is prevented that a white pixel and a black pixel are not set up by turns over the large range by this, and a pattern like a striped pattern arises.

[0024] In addition, this invention is not limited to the above-mentioned example. For example, although the reference pixel is three in the above-mentioned example, the number of the pixels to refer to may be arbitrary. Moreover, although the 1st threshold and the 2nd threshold are considering as the 1st level and the 2nd level which divide a reading range into three equally in the above-mentioned example, the 1st threshold and the 2nd threshold are the level between a white level and black level, and if the direction of the 1st threshold is the level by the side of a white level, it is better [the threshold] than the 2nd threshold at any value. Moreover, although the 3rd threshold is considering as the 3rd level which divides a reading range into two equally, if the 3rd threshold is the level between a white level and black level, it is good at any value.

[0025] Moreover, in the above-mentioned example, although the way of a white level makes image data higher than black level, it can process to image data with the black level conversely higher than a white level. In addition, deformation implementation various in the range which does not deviate from the summary of this invention is possible.

[0026]

[Effect of the Invention] According to this invention As opposed to the pixel corresponding to each pixel data Each of the reference pixel data in which the reference pixel of plurality (three [for example,]) in a position is shown is based on the 1st predetermined threshold and the 2nd predetermined threshold (for example, the 1st level and the 2nd level which divide a reading range into three equally) smaller than this 1st threshold. High brightness, A judgment means to judge whether two or more aforementioned reference pixel data of all are inside brightness while classifying into inside brightness and either of the low brightness, Each pixel data is based on the 1st threshold of the above, and the 2nd threshold of the above, when not judged with all reference pixel data being inside brightness by the aforementioned judgment means. High brightness, A classification means to classify into inside brightness and either of the low brightness, and to classify into either high brightness and low brightness according to the aforementioned judgment means based on the 3rd predetermined threshold (for example, the 3rd level which divides a reading range into two equally) when [all whose reference pixel data are inside brightness] judged, To two pixel data in which a white pixel is shown, the pixel data classified into high brightness according to this classification means, respectively To moreover, one pixel data in which one pixel data in which a white pixel is shown, and black pixel are shown, the pixel data classified into inside brightness And since the pixel data classified into low brightness were equipped with a conversion means to change into two pixel data in which a black pixel is shown, respectively, respectively It becomes the image processing system which can obtain the image data which raised resolution while it had been faithful to an original picture, without producing patterns, such as a striped pattern.

[Translation done.]

TECHNICAL FIELD

[Industrial Application] this invention is used for facsimile apparatus etc. and relates to the image processing system which changes the multiple-value image data of a certain resolution into the binary image data of the resolution of double precision.

[Translation done.]

PRIOR ART

[Description of the Prior Art] The resolution obtained is restricted by the arrangement density of the optoelectric transducer in image sensors when read of a picture is performed using image sensors, such as a CCD line sensor. That is, when the image sensors which come to arrange an optoelectric transducer by mm in eight pieces /are used, resolution is set to mm in 8 pixels /at the maximum.

[0003] For this reason, if it is going to obtain bigger resolution, image sensors with the high arrangement density of an optoelectric transducer will be used. However, since manufacture also becomes difficult while a needed element number increases so that the arrangement density of an optoelectric transducer becomes high, image sensors become expensive. Therefore, if image sensors with the high arrangement density of an optoelectric transducer are used, elevation of equipment cost will be caused.

[0004] Then, classify each pixel into high brightness, inside brightness, and three of low brightness based on the intensity level, and receive the pixel of high brightness. It considers generating binary image data with the resolution of the double precision of the resolution obtained by image sensors by assigning two black pixels for the white pixel of two ** to one white pixel, one black pixel, and the pixel of low brightness, respectively to the pixel of inside brightness. According to this, the image data of high resolution is generable using cheap image sensors with the low arrangement density of an optoelectric transducer.

[0005] However, since a white pixel and a black pixel would be arranged by turns in the picture after conversion when are processed as mentioned above and the pixel classified into inside brightness is continuing, there was fault that patterns, such as a striped pattern, will appear.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] In this invention As opposed to the pixel corresponding to each pixel data Each of the reference pixel data in which the reference pixel of plurality (three [for example,]) in a position is shown is based on the 1st predetermined threshold and the 2nd predetermined threshold (for example, the 1st level and the 2nd level which divide a reading range into three equally) smaller than this 1st threshold. High brightness, A judgment means to judge whether two or more aforementioned reference pixel data of all are inside brightness while classifying into inside brightness and either of the low brightness, Each pixel data is based on the 1st threshold of the above, and the 2nd threshold of the above, when not judged with all reference pixel data being inside brightness by the aforementioned judgment means. High brightness, A classification means to classify into inside brightness and either of the low brightness, and to classify into either high brightness and low brightness according to the aforementioned judgment means based on the 3rd predetermined threshold (for example, the 3rd level which divides a reading range into two equally) when [all whose reference pixel data are inside brightness] judged, To two pixel data in which a white pixel is shown, the pixel data classified into high brightness according to this classification means, respectively Moreover, the pixel data according to which the pixel data classified into inside brightness were classified into one pixel data in which one pixel data in which a white pixel is shown, and black pixel are shown, and low brightness were equipped with a conversion means to change into two pixel data in which a black pixel is shown, respectively, respectively. Therefore, it becomes the image processing system which can obtain the image data which raised resolution while it had been faithful to an original picture, without producing patterns, such as a striped pattern.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] When two pixels were assigned according to the intensity level of each pixel as mentioned above and it processed to a picture of what can raise resolution which the pixel of a gray level follows, for example like a photograph, patterns, such as a striped pattern, appeared in the picture after processing, and there was fault of becoming an unnatural picture.
[0007] this invention is made in consideration of such a situation, and the place made into the purpose is to offer the image processing system which can obtain the image data which raised resolution while it had been faithful to an original picture, without producing patterns, such as a striped pattern.

[Translation done.]

MEANS

[Means for Solving the Problem] In order to attain the above purpose, it is characterized by equipping this invention with the following. As opposed to the pixel corresponding to each pixel data Each of the reference pixel data in which the reference pixel of plurality (three [for example,]) in a position is shown is based on the 1st predetermined threshold and the 2nd predetermined threshold (for example, the 1st level and the 2nd level which divide a reading range into three equally) smaller than this 1st threshold. High brightness, A judgment means to judge whether two or more aforementioned reference pixel data of all are inside brightness while classifying into inside brightness and either of the low brightness. Each pixel data is based on the 1st threshold of the above, and the 2nd threshold of the above, when not judged with all reference pixel data being inside brightness by the aforementioned judgment means. High brightness, A classification means to classify into inside brightness and either of the low brightness, and to classify into either high brightness and low brightness according to the aforementioned judgment means based on the 3rd predetermined threshold (for example, the 3rd level which divides a reading range into two equally) when [all whose reference pixel data are inside brightness] judged. The pixel data according to which the pixel data classified into inside brightness again at two pixel data which the pixel data classified into high brightness according to this classification means show a white pixel, respectively were classified into one pixel data in which one pixel data in which a white pixel is shown, and black pixel are shown, and low brightness are a conversion means to change into two pixel data in which a black pixel is shown, respectively, respectively.

[Translation done.]

OPERATION

[Function] By having provided such a means, it is each pixel data. It is judged to high brightness, inside brightness, and any of low brightness the intensity level belongs fundamentally. To two pixel data in which a white pixel is shown, the pixel data classified into high brightness, respectively Moreover, the pixel data according to which the pixel data classified into inside brightness were classified into one pixel data in which one pixel data in which a white pixel is shown, and black pixel are shown, and low brightness are changed into two pixel data in which a black pixel is shown, respectively. However, the pixel all whose reference pixels of plurality (three [for example,]) that are in a position to each pixel are inside brightness is changed into two white pixels or two black pixels according to whether the intensity level is the 3rd predetermined more than threshold, and is not changed into the combination of one white pixel and one black pixel. Therefore, even if the pixel of inside brightness is continuing, it is prevented that a white pixel and a black pixel arise by turns.

[Translation done.]

EXAMPLE

[Example] Hereafter, with reference to a drawing, it explains per example of this invention. Drawing 1 is the functional block diagram showing the composition of the image processing system concerning this example. Among drawing, 1, 2, and 3 are delay circuits, respectively, and they are connected in series. And image data is inputted into the delay circuit 1, and every 1 pixel of each delay circuits 1-3 is delayed in this image data. In addition, using a CCD line sensor etc., image data carries out the raster scan of the manuscript, is obtained, and becomes by the array of the pixel data to which it comes to show each pixel by the 5-bit intensity level.

[0011] 4, 5, 6, 7, and 8 are comparator circuits, respectively, and the image data which a delay circuit 2 outputs [the image data which a delay circuit 1 outputs / the image data inputted into a comparator circuit 4 at a delay circuit 1 / to a comparator circuit 5] to a comparator circuit 6, and the image data which a delay circuit 3 outputs to a comparator circuit 7 and a comparator circuit 8 are inputted, respectively. Moreover, two thresholds TH2 and tangent line2 which the threshold generating circuit 10 has generated [two thresholds TH1 and tangent line1 which the threshold generating circuit 9 has generated] in the comparator circuit 8 are inputted into each of comparator circuits 4-7, respectively.

[0012] the threshold generating circuit 9 -- white-level >TH1>tangent line1> -- black level -- the predetermined thresholds TH1 and tangent line1 set up so that a relation might be realized are outputted And comparator circuits 4-7 output "0", when the level of input image data is between a threshold TH1 and a threshold tangent line 1 about the level of each input image data as compared with a threshold TH1 and a threshold tangent line 1. Each output of comparator circuits 4-7 is inputted into the threshold generating circuit 10.

[0013] The threshold generating circuit 10 outputs the threshold TH2 of the same value as a threshold TH1, and the threshold tangent line 2 of the same value as a threshold tangent line 1, respectively, when at least one of each of the output of comparator circuits 4-7 is "1." moreover -- the time of each outputs of all of comparator circuits 4-7 being "0" -- white-level >TH2=tangent line2> -- black level -- the predetermined value set up so that a relation might be realized is outputted as thresholds TH2 and tangent line2 And a comparator circuit 8 outputs the signal A1 which shows whether the level of input image data is two or more thresholds TH about the level of input image data as compared with a threshold TH1 and a threshold tangent line 1, and the signal A2 which shows whether the level of input image data is two or more thresholds tangent line, respectively.

[0014] 11 is a resolution conversion circuit and the signals A1 and A2 which a comparator circuit 8 outputs are inputted, respectively. Moreover, the signal B1 and B-2 which the outputs O1 and O2 were delayed by the delay circuit 12 by 1 pixel, and obtained them are inputted into the resolution conversion circuit 11, respectively. And the resolution conversion circuit 11 determines and outputs two signals O1 and O2 which show 1-pixel white/black respectively according to the pattern set up beforehand according to four input signals A1, A2, and B1 and the state of B-2.

[0015] Next, operation of the image processing system constituted as mentioned above is explained. First, after image data is total and receives delay for 3 pixels by delay circuits 1-3, it is inputted into a comparator circuit 8. The threshold generating circuit 10 has given the value equivalent to the 1st level and the 2nd level which were set up so that a reading range (level width of face from a white level to black level) might be equally divided into about three, as usually shown in drawing 2 (a) to the comparator circuit 8 as thresholds TH2 and tangent line2. By the comparator circuit 8, the signal A1 which shows whether the level of image data is higher than the 1st level (it is "1" when high), and the signal A2 which shows whether the level of image data is higher than the 2nd level (it is "1" when high) are outputted in this way. Namely, if a comparator circuit 8 has the level of image data in the range (high brightness) from a white level to the 1st level, it will set both the signals A1 and A2 to "1." If the level of image data is in the range (inside brightness) from the 1st level to the 2nd level, a signal A1 "0", If A2 is set to "1" and the level of image data is in the range (low brightness) from the 2nd level to black level, both the signals A1 and A2 would be set to "0", and it will have classified into high brightness, inside brightness, and either of the low brightness.

[0016] On the other hand, the threshold generating circuit 9 is always outputting the value equivalent to the 1st level and the 2nd level which were set up so that a reading range might be equally divided into about three, as shown in drawing 2 (a) as thresholds TH1 and tangent line1. Therefore, also in comparator circuits 4-7, comparison with the level of image data, the 1st level, and the 2nd level is performed. However, the image data before being delayed by the delay circuit 1 to a comparator circuit 4 Data after the image data after being delayed by the delay circuit 1 to the comparator circuit 5 was delayed by delay circuits 1 and 2 to the comparator circuit 6, respectively And since data after being delayed by delay circuits 1-3, respectively are inputted into the comparator circuit 7, respectively A comparator circuit 7 is related with the pixel data in front of one about the pixel data inputted into the comparator circuit 8 at main scanning direction to the pixel data by which the comparator circuit 6 is inputted into the comparator circuit 8. A comparator circuit 5 compares level with main scanning direction about the pixel data in front of three about the pixel data in front of two at main scanning direction to the pixel data into which the comparator circuit 4 is inputted at the comparator circuit 8 to the pixel data inputted into the comparator circuit 8, respectively. Moreover, comparator circuits 4-7 are making only a judgment whether they are whether the level of image data is between the 1st level and the 2nd level, and inside brightness.

[0017] And if at least one of each outputs of comparator circuits 4-7 is "1", the threshold generating circuit 10 As opposed to the pixel data inputted into the comparator circuit 8, and this pixel data to main scanning direction Namely, before one, Thresholds TH2 and tangent line2 are outputted as mentioned above noting that it will be a normal state, if at least one of four pixel data (main scanning direction is followed) with each pixel data in front of two and three is classified in addition to "halftone."

[0018] However, when all of each output of comparator circuits 4-7 of the threshold generating circuit 10 are "0", As opposed to the pixel data inputted into the comparator circuit 8, and this pixel data to main scanning direction Namely, before one, When all of the four pixel data (main scanning direction is followed) with each pixel data in front of two and three are classified into "halftone", thresholds TH2 and tangent line2 are changed with a normal state. Let thresholds TH2 and tangent line2 be the values equivalent to the 3rd level which specifically [both] divides a reading range into about two equally as shown in drawing 2 (a).

[0019] Both the signals A1 and A2 that will be outputted from a comparator circuit 8 if it does so turn into a signal which shows whether the level of image data is the 3rd more than level, if the level of image data is the 3rd more than level, they will set both the signals A1 and A2 to "1", and if the level of image data is the 3rd less than level, they will set both the signals A1 and A2 to "0." That is, in this state, a comparator circuit 8 will carry out operation same with making image data binary simply.

[0020] Now, the resolution conversion circuit 11 searchs the signal B1 which the signals A1 and A2 which a comparator circuit 8 outputs, and a delay circuit 12 output, and the table shown in drawing 3 based on B-2, and determines it as either of "0" which shows "1" or the black pixel which shows a white pixel for signals O1 and O2, respectively. Specifically [both], when [both] signals A1 and A2 are "1", signals O1 and O2 are set to "1" irrespective of a signal B1 and the state of B-2. Moreover, when [both] both the signals A1 and A2 are "0", signals O1 and O2 are set to "0" irrespective of a signal B1 and the state of B-2. And by "0", when a signal A2 is "1", a signal A1 sets either of the signals O1 and O2 to "0", and sets another side to "1." However, when both a signal B1 and B-2 are "0" with reference to a signal B1 and the state of B-2 at this time, a signal O1 is set to "0", a signal O2 is set to "1", in except [it], a signal O1 is set to "1" and a signal O2 is set to "0." In addition, a signal O1 corresponds to the pixel of a main-scanning-direction anterior, and a signal O2 corresponds to the pixel of a main-scanning-direction posterior, respectively.

[0021] It is changed into the array of a pixel as shown in drawing 2 (c) when processing by the above processings to a picture signal as shown in drawing 2 (a) which shows the array of a pixel as shown in drawing 2 (b) in this way. That is, the pixel P2 according to which an intensity level is classified into high brightness, P5, and P12 are changed into two white pixels, respectively. Moreover, the pixels P1 and P3 according to which an intensity level is classified into low brightness are changed into two black pixels, respectively. And the pixel according to which an intensity level is classified into inside

brightness is usually changed into one white pixel and one black pixel. The pixel (the pixel P4 in drawing 2 corresponds) from which the front pixel is changed into two black pixels according to the conversion situation of a front pixel in this case the pixel of an anterior In addition, a black pixel, The pixel (the pixels P7 and P8 in drawing 2 correspond) changed into the pixel (the pixel P6 in drawing 2 corresponds) or one black pixel from which the pixel of a posterior is made into a white pixel, and the front pixel is changed into two white pixels, and one white pixel makes a white pixel and the pixel of a posterior a black pixel for the pixel of an anterior. Even if an intensity level is the pixel classified into inside brightness, however, the pixel (the pixels P9, P10, and P11 in drawing 2 correspond) all of whose three pixels of an anterior are inside brightness The pixel (the pixel P11 in drawing 2 corresponds) whose intensity level is the 3rd more than level is made into two white pixels, and let the pixels (the pixels P9 and P10 in drawing 2 correspond) with which an intensity level does not fill the 3rd level be two black pixels.

[0022] According to this example, the intensity level of each pixel fundamentally Thus, high brightness, The pixel belonging to high brightness according to to inside brightness and three any of low brightness it belongs to two white pixels The image data which has the resolution of the double precision of the image data of a basis is generated by changing into two black pixels the pixel to which the pixel belonging to inside brightness belongs to one white pixel, one black pixel, and low brightness, respectively.

[0023] And although the pixel to the 3rd is changed into one white pixel and one black pixel like **** when four or more pixels of inside brightness continue, the pixel after the 4th is changed into two white pixels or two black pixels according to whether it is the 3rd more than level which the intensity level reads and divides a range into two equally. It is prevented that a white pixel and a black pixel are not set up by turns over the large range by this, and a pattern like a striped pattern arises.

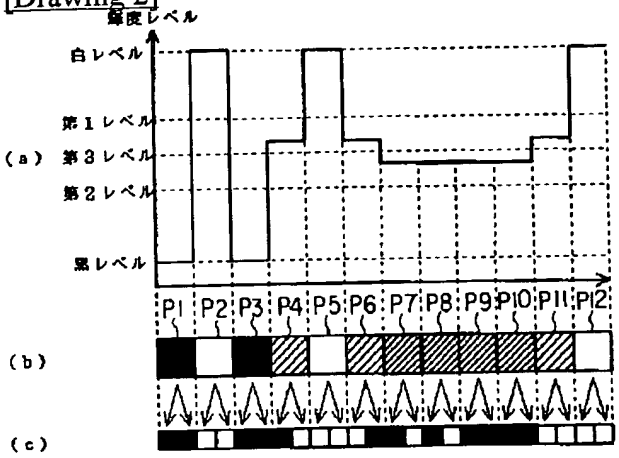
[0024] In addition, this invention is not limited to the above-mentioned example. For example, although the reference pixel is three in the above-mentioned example, the number of the pixels to refer to may be arbitrary. Moreover, although the 1st threshold and the 2nd threshold are considering as the 1st level and the 2nd level which divide a reading range into three equally in the above-mentioned example, the 1st threshold and the 2nd threshold are the level between a white level and black level, and if the direction of the 1st threshold is the level by the side of a white level, it is better [the threshold] than the 2nd threshold at any value. Moreover, although the 3rd threshold is considering as the 3rd level which divides a reading range into two equally, if the 3rd threshold is the level between a white level and black level, it is good at any value.

[0025] Moreover, in the above-mentioned example, although the way of a white level makes image data higher than black level, it can process to image data with the black level conversely higher than a white level. In addition, deformation implementation various in the range which does not deviate from the summary of this invention is possible.

[Translation done.]

DRAWINGS

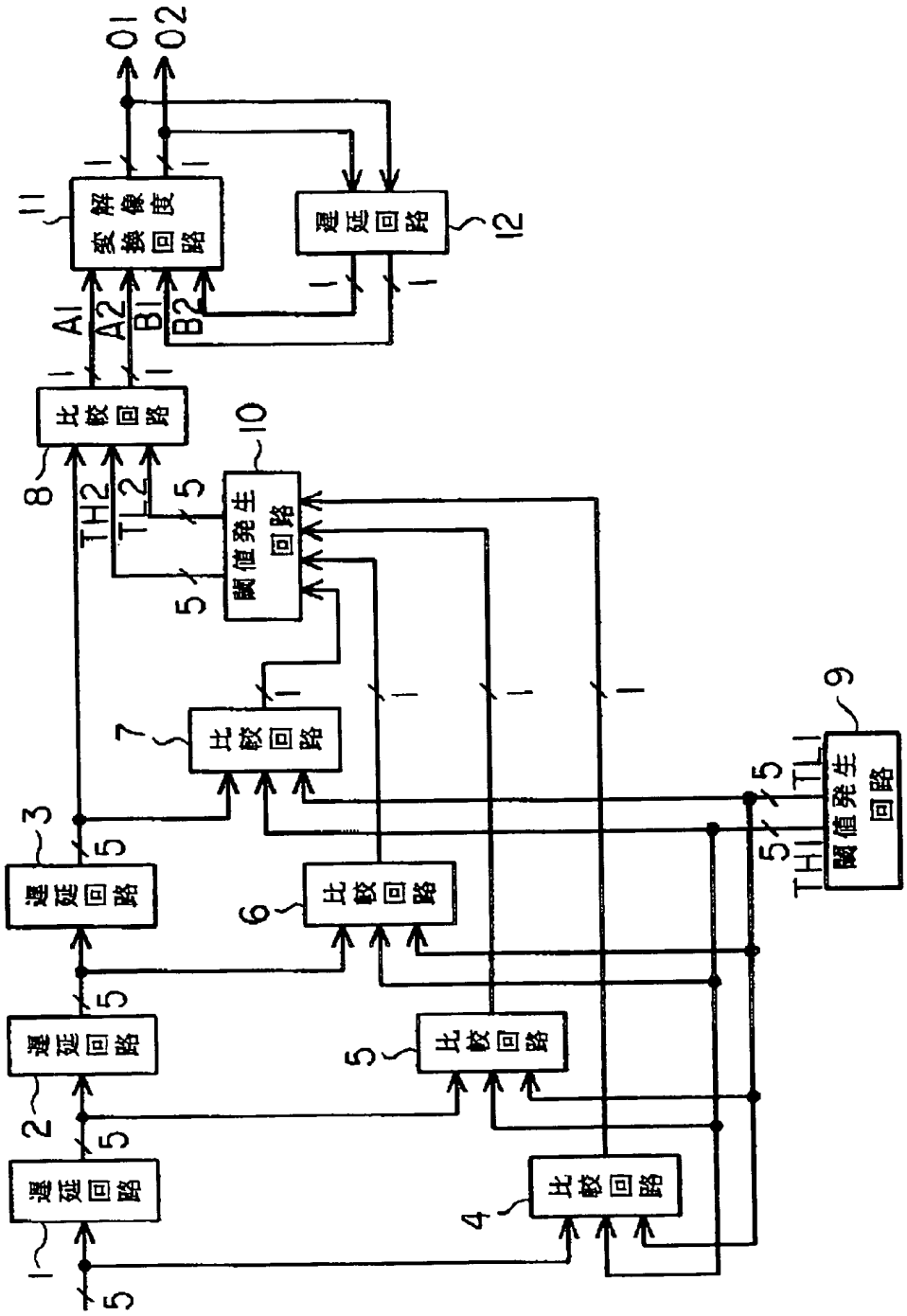
[Drawing 2]



[Drawing 3]

入力信号				出力信号	
A1	A2	B1	B2	O1	O2
1	1	0/1	0/1	1	1
0	0	0/1	0/1	0	0
0	1	0	0	0	1
0	1	0	1	1	0
0	1	1	0	1	0
0	1	1	1	1	0

[Drawing 1]



[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The functional block diagram showing the composition of the image processing system concerning one example of this invention.
[Drawing 2] Drawing explaining an example of transform processing of the image data in the image processing system of this invention.
[Drawing 3] Drawing showing typically the content of the table used in case the resolution conversion circuit 11 in drawing 1 determines two pixels.
[Description of Notations]
1, 2, 3, 12 -- Delay circuit
4, 5, 6, 7, 8 -- Comparator circuit
9 10 -- Threshold generating circuit
11 -- Resolution conversion circuit

[Translation done.]

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TITLE: Image processor for converting multivalue image data to binary value image data - converts one pixel data into two pixel data, one black and one white or both white or both black depending upon classification done using threshold levels

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Basic Abstract Text - ABTX (1):

The image processor converts the image data into an array of binary pixel data arranged in two dimensions. A threshold generator (10) generates two threshold levels (TH2, TL2) which divide the reading range equally into three. A comparator circuit (8) along with the delay circuits (1-3) and comparator circuits (4-7) form the judgment part to classify the input pixel data. The pixel data is classified into two low medium and high brightness.